Emission Control Byproducts - Treatment and Use

A Consortium of FETC, the Electric Power Industry, and Academia

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Background

In order to comply with recent amendments to the Clean Air Act many Utilities, particularly those in the eastern U.S. are retrofitting existing generating stations with flue gas desulfurization (FGD) units. Others are controlling acid forming nitrogen oxides with low NOx burners. These technologies produce new byproducts which, depending on how they are handled, can be environmental liabilities or marketable materials.

The volumes of materials are huge. For example, a single FGD unit serving a 550 megawatt generating facility will typically generate 510 tpd of sludge and 25,000 gpd of effluent. Low NOx burners, on the other hand, generate an ash which differs from conventional fly ash by retaining 15 to 25% residual carbon. The resulting high loss on ignition (LOI) ash is normally unsuitable for making cement-a market for substantial volumes of conventional fly ash.

FGD sludge consists of a solid phase-gypsum sometimes mixed with fly ash-and a liquid phase. In the liquid phase chloride concentrations often exceed 10,000 mg/l. This restricts discharge options. It can also restrict the use of the solid phase material unless the chloride is removed. For example, chloride will degrade gypsum's value for wallboard, cements and agricultural applications.

The costs of permitting and operating disposal facilities for these materials are significant. With additional FGD and low NOx units coming on line the problems will increase unless a systematic effort is undertaken to mitigate the toxicities of these materials and find uses for marketable products.

Objective

The objective of the program is to develop technologies for use by the coal utilities and their suppliers which will be useful in solving problems related to the handling of byproducts from their clean coal processes. These processes would include but not be limited to Flue Gas Desulfurization and Low NOx burner technologies.

Strategy

The strategy recognizes the unique role of the private sector in commercializing technology. It also recognizes the key role within the Federal Governmental of the U.S. Department of Energy Fossil Energy Program. The program would be guided by the coal utilities and their suppliers and the USDOE Federal Energy Technology Center at Morgantown.

The following is an example of how the strategy might be outlined. Only several of potentially many byproducts are discussed here:

Identify products of clean coal technologies, characterize them and evaluate disposal and beneficial use options.

1. Characterize product streams from FGD's and low NOx burners, develop a list of potential market opportunities and disposal options.

   FGD solids:
   Sources: FGD scrubbers, producing gypsum or Mixed-fly ash/gypsum.
   Composition: Gypsum or fly ash mixed with gypsum, sulfites and other minerals in 20% solids content slurry.
   Issues: Dewatering, disposal, permitting, monitoring, compliance

   FGD liquids:
   Source: Recirculated lime slurry makeup water.
   Composition: High dissolved solids, low suspended solids, Cl^- concentrations above 10,000 mg/l, strongly alkaline.
   Issues: Disposal, upgrading, chemical separations.

   High LOI ash:
   Source: Low NOx burners.
   Composition: Class F ash plus 10 to 25% residual carbon compounds.
   Issues: Leachates, disposal, handling requirements, site permitting and compliance.

2. Identify potential disposal and market opportunities.

   FGD solids: Barrier materials for surface and underground mine backfill, gypsum products such as wallboard, fertilizer and cement additives.

   FGD liquids: Evaporative treatment, use as cooling water, sources of $Ca(Cl)_2$, Cl gas, $Ca(OH)_2$.

   High LOI ash: Evaluate effectiveness as a low cost source of activated carbon, e.g. for toxic ion removal in waste site cleanup.

3. Develop and implement research and demonstration program around identified priority topics.

Organization/Management

The program would be directed by a management committee consisting of representatives of the participating companies and USDOE/FETC. The management committee would set priorities, approve research projects and review progress at regular meetings. The research program would be organized by the National Mine Land Reclamation Center at West Virginia University in cooperation with its partner-the Environmental Resources Research Institute at Pennsylvania State University. It is anticipated that significant research will be undertaken in collaboration with FETC and the corporate participants.

The National Mine Land Reclamation Center

The Center was established in 1988. It is organized into three regions-the Eastern Region consists of West Virginia University and Pennsylvania State University. The Center has become the lead institute in the nation in the beneficial application of industrial byproducts for pollution control for the mining industry. We have found applications for kiln dust and fluidized bed combustion ash which are accepted by the industry, the regulatory agencies and the public. In fact, demand for these products is now exceeding supply.

We cannot guarantee this kind of success with FGD products and high LOI ashes. However, our record indicates our commitment to and performance in working with the industry and the regulatory agencies to find practical and beneficial applications for materials which, only five years ago were considered to be environmental liabilities.

Funding

Base funding is requested through a cooperative agreement between the USDOE Federal Energy Technology Center at Morgantown and the National Mine Land Reclamation Center at West Virginia University. This funding would provide basic research and information to the management committee. The management committee would then use this information to direct applied demonstration projects. As projects move to the demonstration stage, companies would be solicited to provide sites, in-kind and/or direct financial support toward their specific needs.

Funding for Phase I is set at $66,127.00 (May through November 1998), Phase II (November 1998 through September 1999) at $300,000, Phase III (FY 2000) at $397,000. Cost sharing of 25% is required for projects supported under this consortium.